

## **Considerations for Artificial Intelligence and Machine Learning Applications in Electronic Monitoring**

*This paper is part of a series that summarizes discussions from the 2022 Global Electronic Monitoring Symposium,<sup>1</sup> which convened more than 50 EM experts, both in person and virtually, for a three-day workshop. The symposium focused both on the use of electronic monitoring programs to increase oversight and transparency in international fisheries management and on existing barriers to the uptake of EM. Although this series of papers does not represent an exhaustive discussion of the issues, it includes the key points that symposium participants raised.*

### **Introduction**

Global Electronic Monitoring Symposium (GEMS) participants noted that the EM review process is one of the major challenges to scaling electronic monitoring (EM) worldwide. Extracting data and reviewing video footage, a key element of an EM program, forms the most significant ongoing cost: the more footage reviewed, and the more detailed the data, the more expensive the process. To prevent burdening those responsible with manually reviewing millions of hours of footage annually, many fishery stakeholders are looking to use artificial intelligence (AI) and machine learning (ML) applications to conduct reviews.

Potential uses of AI/ML are numerous across the different phases and uses of EM data; almost any stage of EM in which decisions are made based on data (e.g., video review or annotation) could be automated by ML algorithms. AI/ML also has the potential for EM cost-reducing opportunities. However, stakeholders need to be pragmatic and informed about how AI/ML is developed, including the cost; how AI/ML is integrated into the review process; what AI/ML can be used for currently; and what is needed in the future to integrate AI/ML into new EM programs.

### **Key areas of discussion related to AI/ML**

1. *Managing expectations and prioritizing investment.* GEMS participants stressed the importance of managing stakeholder expectations on what aspects of AI/ML are currently scalable for commercial fisheries, as well as the investment needed for its increased utility. Participants discussed AI/ML tools that help prioritize image analysis, such as identifying when a vessel is not fishing or does not have catch on deck, which can greatly reduce the volume of footage to be reviewed. GEMS

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<sup>1</sup> GEMS Steering Committee members are Andrew Clayton, Claire van der Geest, Esther Wozniak, Eugene Pangelinan, Gerald Leape, Mark Zimring, Papa Kebe, Robert Gillett and Ruth Hoban.

participants also considered current efforts to develop AI/ML models that can identify fish species and provide weight estimates. However, several EM trials that have included AI/ML applications are not yet scalable or cost-effective for commercial fisheries. More resources (e.g., more data to train algorithms) and time will be needed to increase what AI/ML can be used for—particularly identifying catch and detecting rare bycatch events. Managers must weigh the tradeoffs in investing in these applications and continuing to use existing, older systems to reduce data burdens. Clear EM program objectives can help fishery managers determine where to best invest in AI/ML applications, such as scrubbing dead time, detecting catch, identifying species or detecting anomalies.

2. Data-sharing agreements. Fishery stakeholders recognize that more data, especially images, are needed to train current and future AI/ML models. Therefore, GEMS participants highlighted data-sharing agreements as a tool to help increase utility of data while also managing any legal requirements between entities, particularly for multi-jurisdictional fisheries. Data-sharing agreements with AI/ML providers should be developed with clear privacy requirements and data-handling procedures. Increased information sharing, even if one of the countries or stakeholders has only limited capacity for reciprocity, will benefit and facilitate trust among international fishery stakeholders.
3. The human elements of AI/ML. Humans are central to ensuring the success of EM programs and AI/ML should be designed in a way to complement current livelihoods. GEMS participants noted the potential for investment in employment opportunities that improve and build AI/ML infrastructure (e.g., labeling images). Participants also noted that AI/ML needs must account for and be respectful of the vessel's crew, limiting potential interruptions of deck workflow, as well as consider equitable compensation to fishers who support collecting data. GEMS participants also stressed the importance of education, collaboration and communication between AI developers, EM vendors and fishery observers and managers.

### **Next steps**

GEMS participants broadly agreed that AI/ML has the potential to improve the efficiency and reduce costs of EM programs. AI/ML has already proved its effectiveness in flagging events for human review and streamlining some data flows. However, more work is needed if these applications are going to be scaled up, in particular:

- Developing a compendium of available AI/ML literature and information on where these applications are being tested.

- Supporting the inclusion and participation of EM vendors and AI/ML developers in creating and/or expanding EM programs.
- Promoting the use of data-sharing agreements between relevant parties.
- Considering the hierarchical importance and prioritization of AI/ML applications for EM (e.g., scrubbing dead time, detecting catch, identifying species, detecting anomalies).
- Fostering spaces for collaboration and education—such as The Pew Charitable Trusts’ AI Summit in 2023—between EM vendors, AI/ML developers and other fishery stakeholders.
- Developing a glossary for policymakers to use, as terminology can vary widely.